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EXAMINER				
VAN ROY, TOD THOMAS				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/763,390

**Applicant(s)**

SCHLUETER ET AL.

**Examiner**

TOD T. VAN ROY

**Art Unit**

2828

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 December 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 and 4-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 4-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB06)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Amendment***

The Examiner acknowledges the amending of claims 1, 13, 30, the cancellation of claim 10 and the addition of claims 31-33.

### ***Response to Arguments***

Applicant's arguments filed 12/04/2007 have been fully considered but they are not persuasive.

The Applicant has argued that Desurvire does not teach the radiation produced to have less than about 10% overlap with the active region. The Examiner does not agree.

Table 1 of Desurvire teaches the mode size of the fundamental mode to be 4.09 $\mu$ m. Figure 11 then shows that epsilon (ratio of Er doped (active) core radius to the fiber radius) can be decreased towards zero, at the same time increasing the gain coefficient. If the mode size is taught to be 4.09 $\mu$ m, while the active area can be reduced towards zero as the fiber radius remains constant, as shown in fig.11, then the overlap of the mode with the active region becomes smaller and smaller. Figure 11 teaches the active region can be reduced to a theoretical zero value, making the percentage overlap with the mode essentially any desired value.

The Examiner also notes the use of the 01 notation in table 1, referring to the lowest order mode. As previously noted in claim 10, "the lasing threshold can be considered the threshold at which only the 01 mode is supported, at that point the system would not have enough gain available for other modes to overcome the losses

of the cavity". Further, col.6 line 3 of Desurvire mentions compatibility of this fiber type with a single mode communication fiber, thereby meaning that the amplifier should support only the desired mode at any given time so as to maintain a clear signal from the input single mode fiber.

### ***Claim Objections***

The previous objection to claim 13 is withdrawn.

Claim 29 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4-6, 8-9, 11, and 25-30 are rejected under 35 U.S.C. 102 (b) as being anticipated by Desurvire et al. (US 5027079).

With respect to claims 1, 4-5, and 29, Desurvire discloses an optical fiber for producing laser radiation at a characteristic wavelength (1.531um), the optical fiber comprising: a first multimode core region (larger clad, fig.3) having a first index of refraction (inherent), the core region being adapted for guiding the laser radiation in a

longitudinal direction of the fiber and adapted for guiding pump radiation (due to index contrast with the inner core), and an active region embedded within the core region for producing radiation at the characteristic wavelength when pumped by pump radiation (col.3 lines 40-56), the active region having a sufficiently small transverse dimension such that less than about 10% of the radiation produced at the characteristic wavelength in the active region is confined to the active region, and further the optical fiber has gain along its longitudinal direction (inherent, doping) that is sufficiently small, so that a desired laser mode operates above a lasing threshold while all other modes operate below the lasing threshold (the lasing threshold can be considered the threshold at which only the 01 mode is supported, at that point the system would not have enough gain available for other modes to overcome the losses of the cavity).

*Fig.11, type A, When epsilon (ratio of Er doped core radius to fiber radius) goes towards zero, the gain coefficient increases and the overlap percentage with the radiation produced at the fundamental mode (table 1, 4.09um signal power mode size) reduces to any value, determined by the core radius chosen, even less than 1%.*

*Core radius reduced -> gain coefficient increases -> overlap with disclosed 4.09 mode size reduced (disclosed for all values on trend line in fig. 11, type A)*

With respect to claims 6 and 26, Desurvire discloses the transverse dimension of the active region (fig.11, can be reduced to any non-zero value) is smaller than the characteristic wavelength (1.531um).

With respect to claims 8-9, and 27-28, Desurvire discloses the desired mode is the lowest order mode (table 1, 01, which would be Gaussian).

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With respect to claims 11 and 25, Desurvire discloses a mode discriminator for discriminating against undesired modes of light generated in the fiber while allowing a desired mode of light to propagate in the fiber (fiber dimensions can be considered a mode discriminator).

With respect to claim 30, Desurvire discloses a method of providing laser energy that is described by the disclosed system of claims 1 and 6 above.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Desurvire in view of Arbore (US 6970631).

With respect to claim 7, Desurvire teaches the system of claim 1, but does not teach the use of multiple indices of refraction in the active region. Arbore teaches a fiber system wherein the active region (fig.1 #12/14) is made up of multiple indices of

refraction. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Desurvire with the active region of Arbore in order to affect a larger degree of control over the guided mode via use of multiple index waveguiding.

Claims 12-14 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Desurvire in view of Fermann et al. (US 6954575).

With respect to claims 12-14, Desurvire teaches the fiber system as outlined in the rejection to claim 11, but does not teach a free space propagation path defined between a mirror and the multimode fiber. Fermann teaches a fiber system which uses a mirror (saturable absorbing) between a free space propagation path and a multimode fiber (fig.11, col.14 lines 51-67, being used for active mode locking, inherently filtering out and reflecting back to the fiber only the desired mode). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Desurvire with the propagation/ mirror system of Fermann in order to enable active mode locking and the generation of short optical pulses (Fermann, col.14 lines 62-67).

With respect to claim 18, Desurvire teaches the fiber system as outlined in the rejection to claim 11, but does not teach the use of fiber gratings. Fermann teaches a fiber system which uses a fiber grating (col.15 lines 1-13). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Desurvire with the grating of Fermann in order to further restrict the modal profile of the system, as is a widely known and used function of fiber gratings.

Claims 11, 13, 15-17, and 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Desurvire in view of Caracci et al. (US 6445838).

With respect to claims 11, 13, 15-17, and 31-32, Desurvire teaches the fiber system as outlined in the rejection to claim 11, but does not teach a second optical fiber for guiding the laser radiation, wherein the mode discriminator is a free space propagation path between the first multimode fiber and the second multimode fiber, or a lens disposed between said fibers. Caracci teaches a tunable optical component which uses a split in a fiber segment, creating a free space path, as well as a lens (col.6 lines 27-34), to tune the wavelength. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Desurvire with the splitting technique of Caracci, resulting in two multimode fiber sections, in order to have the ability to tune the confined light, eliminating unwanted modes, as well as to use a lens to insure the proper coupling of the light from segment to segment.

With respect to claim 33, Desurvire and Caracci teach the device outlined in the rejection to claim 32 above, including the optical element is adapted to discriminate against various modes (via the FP cavity location) as well as the supported mode to be selectable. Desurvire and Caracci do not specify the device to discriminate against lower order modes and support a higher order mode. It would have been obvious to one of ordinary skill in the art at the time of the invention to adapt the variable mode selector of Desurvire and Caracci to select a higher order mode versus a lower order mode as a



matter of design choice, allowing for the selection of a mode to best fit the given application.

Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Desurvire in view of Wyatt et al. (US 5774484).

With respect to claims 19-20, Desurvire teaches the fiber system as outlined in the rejection to claim 11, but does not teach a second multimode fiber for guiding the laser radiation, and wherein the mode discriminator is a third multimode fiber (with radially varying index) located between the first multimode fiber and the second. Wyatt teaches an optical fiber system wherein is used a second multimode fiber for guiding the laser radiation, and wherein the mode discriminator is a third multimode fiber (radially varying index, col.3 lines 30-35) located between the first multimode fiber and the second (fig.3, fibers 1a, 2a, 1b, 2b, mode discrimination occurring via gratings in fiber 2a). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Desurvire with the multi-fiber system of Wyatt in order to perform mono-mode up-conversion of the pump laser beam (Wyatt, col.4 lines 30-45) to obtain frequencies not available from the pump source.

Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Desurvire in view of Zellmer et al. (US 2002/0018287).

With respect to claims 21-24, Desurvire teaches the fiber system as outlined in the rejection to claim 11, but does not teach the use of multiple sections of fiber bent in

the shape of kidneys, lying in non-parallel planes. Zellmer teaches a fiber system which uses multiple sections of fiber bent in the shape of kidneys, lying in non-parallel planes (fig.6 #27, multiple bent sections, in the shape of kidneys, lying in non-parallel planes). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the fiber system of Desurvire with the bent fiber sections of Zellmer in order to allow for selection, or elimination, of transverse modes in the waveguide (Zellmer, [0022], [0030]).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TOD T. VAN ROY whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR

/Minsun Harvey/  
Supervisory Patent Examiner, Art Unit 2828